

# Dental erosion and GORD - Gastro Oesophageal Reflux Disorder

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## Abstract

Acid erosion of teeth from extrinsic sources, such as acidic beverages, renders damage to teeth with characteristic erosive patterns developing. Gastro Oesophageal Reflux Disorder (GORD) is frequently cited as a stand alone condition causing dental palatal erosion. It is often referred to as Gastro Oesophageal Reflux Disease GORD or GERD. GORD is a pathophysiological disorder rather than a disease, as GORD is not contagious, infectious or transmissible through contact. GORD is a common condition universally affecting many people, mainly young females. Etiologies embrace eating disorders including bulimia and anorexia nervosa, dysfunctional oesophageal sphincters allowing acid gastric juice migration into the mouth, chronic alcoholism and pregnancy. GORD is also responsible for tooth erosion, but generally manifests destruction on the palatal side of dental crowns. This article describes cases of typical tooth erosion deriving from GORD and acid beverages, compares the two and principles of therapy are outlined.

## Introduction

Tooth erosion from acids may be caused by intrinsic and extrinsic factors. Gastro Oesophageal Reflux Disorder (GORD) with Erosion is prime among intrinsic factors. Hydrochloric acid (HCl) is produced in the gastric mucosa by parietal cells. Etiologies of GORD include eating disorders like bulimia and anorexia nervosa, rumination, chronic alcoholism, pregnancy and other conditions with dysfunctional oesophageal sphincters, which allow acid gastric juices to migrate into the mouth.

This paper appraises common intrinsic causes of GORD, when gastric content is projected into the oral cavity either through regurgitation or induced vomiting. Dental erosion as a cardinal, yet early feature of GORD, is discussed based on various etiologies. Cases of typical eating disorders are presented. Characteristic features arising from external factors like abusive acidulated beverage consumption, are described. Comparisons between erosion deriving from GORD and other intrinsic and extrinsic causes are highlighted.

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## Intrinsic factors causing dental erosion Eating disorders

Prime among common eating disorders that manifest GORD are bulimia, anorexia, alcoholism, rumination and alcoholism.

Bulimia nervosa, a common eating disorder mainly among young women, in which affected people routinely and regularly induce post-prandial emesis, has long been recognised as a major factor inducing dental erosion (Klein and Walsh 2004). See Figures 1a-c. Physical and psychosocial compromise may obtain in the long run, but it takes much longer to manifest when compared to anorexia nervosa.

Early erosive lesions appear as thinning of enamel, especially palatally with progressive softening and loss of calcified tooth substance. With persistent repeated tongue friction against coronal enamel softening, dentine is eventually exposed, and ultimately in severe cases the pulp may become compromised. With progressive erosion, destruction may not be limited to the palatal surfaces, and other dental surfaces in the mouth become affected.

Binge-eating followed by self-induced post-prandial vomiting needs to occur more than twice per week for at least twelve weeks, before a definitive diagnosis of Bulimia nervosa is made. Bulimia nervosa is recognised as being



**Figure 1a-c:** The teeth in 1a and b of a bulimic sufferer. The palatal surfaces of the upper anterior teeth (2C) are markedly affected with erosive loss of enamel by the acid contents from induced vomiting. Dentine is exposed palatally because of lingual friction removing softened tooth material, and the enamel has thinned. This is typical erosion loss from GORD.

**Figure 2:** A 20-year-old female; chronic sufferer from Anorexia nervosa, that started at puberty. Note advanced cachexia. Anorexia is diagnosed when sufferers have body weight less than 85% of their ideal body weight. Her only intake of food was limited to sucking a few lemon drop sweets.

**Figure 3:** The teeth from the person in Figure 2 above, showing repair of extensive cervical caries. The remaining enamel shows signs of decalcification.



distinct from other eating disorders (Russell 1979).

Loss of personal appetite control leads to excessive over-eating, and is followed by self-induced emesis, which is typical behaviour aimed at avoiding weight gain (Gottfried et al 1978). The age range affected varies, but bulimics tend to be older than anorexics, with bulimia occurring often in the twenties, and anorexia impacting early-to-late teenagers. Cases of females dominate with a female:male ratios as high as F10:M1, and the prevalence among females is low at 3% (Klein and Walsh 2004).

In the early stages body weight may be normal, but if it drops then anorexia becomes part of the condition (Bartlett 2006). Regular purging may lead to metabolic disturbances, among which would be electrolyte imbalances that may produce severe systemic aberrations. Cardiac arrhythmias and blood pressure changes from sodium, potassium, chloride and calcium ion depletions may arise. Bulimics have tendencies to self-abuse using alcohol, laxatives and diuretics, behaviours which are less prevalent among anorexics (Lilenfeld et al 2000, Touyz et al 1993).

Anorexia nervosa (AN) is an eating disorder with persistent avoidance of food or eating behaviour, which impairs physical or psychosocial function, and is not related to other medical conditions (Klein and Walsh 2004, Russell 1979, Melosovic and Slade 1989) See Figures 2 and 3.

Anorexia nervosa and bulimia are two eating disorders which both may have some similarities, as both manifest dental erosion and/or decay, but which are not identical.

Table 1 lists some of these.

With anorexia nervosa (AN) there is a relentless pursuit of thinness, with four fundamental features defining the condition (1) severe weight loss with body: bodyweight being less than 85% of their ideal (2) amenorrhoea (3) psychological disturbances and (4) and hyperactivity (Klein and Walsh 2004).

The pursuit continues despite being emaciated and underweight. Sufferers continue to avoid food motivated by a distorted body image of self, driving them to further food restriction (Bartlett 2006). Two major clinical types exist: food restriction and binge/purge types. Food restriction types eschew eating by dietary limitations, and the purge/binge types indulge in self-induced emesis and abuse of laxatives (Klein and Walsh 2004). Various proportions and combinations between these two types occur. AN is a socio-cultural disease affecting mainly white, middle and upper-class women between ages of 12 to 30 years (Melosovic and Slade 1989). The annual incidence of AN in the United Kingdom of Britain is about 0.6 to 1.6 per 100 000 (Kendal et al 1973). It is predominantly prevalent in Westernised Industrial Societies and is ten times more common in young women than men (Williamson et al 2004).

Early detection of signs of bulimic erosion may be detected by dental healthcare professionals, as most teenagers and young adults attend dentists for maintenance and oro-dental health care. Treatment for bulimia is difficult, especially in established cases. Therapy is

**Table 1**

Comparison of eating disorders: based on Bartlett (2006).

<b>Bulimia</b>	<b>Anorexia Nervosa</b>
Mainly females	Mainly Females
Low self-image	Low self-image
Common in Western Society	Western Society
Compulsive	Compulsive
Intelligent	Intelligent
Late adolescent	Early adolescent
Binge eating and Purging	Severe voluntary sustained dietary restriction
Normal body weight: some reserve	Low body weight: scant tissue reserve
Electrolyte imbalance	Low metabolic rate
Drug and alcohol abuse	Minimal drug abuse.

directed at intervention therapy that assists in regaining physical strength, establishing general health, improving the self-image, esteem and confidence, breaking the destructive behaviour pattern and reducing symptoms. This may be achieved with medication and psychological counselling (Herzog and Copeland 1985, Becker et al 1999).

### **Alcoholism**

Alcoholism is an addiction to ethanol which has serious effects on the physical and social well being of the addict. Chronic gastritis leads to vomiting, and the regurgitated stomach contents, being highly acid, erodes the teeth. Gastritis also leads to GORD (Gottfried et al 1978). Erosion is frequently on the upper palatal aspects of the teeth, but also occlusal wear from softening and bruxism is also prevalent (Gottfried et al 1978). Alcoholics are notorious for not eating balanced diets, and tooth damage is more prevalent because of their preference for acidic food and drinks (Robb and Smith 1990).

### **Rumination**

Rumination occurs when people voluntarily regurgitate gastric contents, swish or re-chew the bolus and then swallow again. This is achieved by increasing intra-abdominal pressure and relaxation of the oesophageal sphincters that allows the gastric chime to track up the oesophagus into the mouth (Levine et al 1983, Gilmour and Beckett 1994). This is a typical example of GORD. Further, the teeth show indicative palatal erosive destruction similar to other intrinsic causes of GORD (Gilmour and Beckett 1994).

### **Pica, nausea and GORD in pregnancy**

During pregnancy, nausea and morning sickness is well known, and is a cause of GORD from frequent emesis. Consequently, palatal dental erosion from chronic vomiting in pregnancy is possible (Gilmour and Beckett 1994). Pregnancy produces uncontrollable desires for unusual foods. This is known as 'pica', and frequently it is not only the desire for strange combinations of food, like chocolate and fish, but also for acidic foods like lemons, pickled cucumbers and vinegar. Pica frequently drives women to consume excess amounts of acid in foods or drink, and this may lead to tooth erosions. The pica drive usually abates after pregnancy. Abdominal distortion and pressure distension in the late stages of pregnancy may also lead to GORD (McLoughlin and Hassaneyah 1990) See Figure 4.

### **Gastro Oesophageal Reflux Disease (GORD)**

This is frequently blamed as a stand alone condition causing dental palatal erosion. It is often referred to as GORD or GERD. GORD is a patho-physiological set of symptoms rather than a disease, as GORD is not contagious, infectious or transmissible through contact. The aetiology of GORD is variable but when the gastric contents flows from the stomach to the mouth, it is called Gastro-oesophageal reflux disorder (GORD) (Chandra et al 2004). Common symptoms are: Heart-burn along the oesophageal pathway; epigastric pain localised over the stomach; regurgitation into the mouth; dysphagia with or without pain; non-cardiac retro-sternal pain; chronic coughing and sore throat from laryngitis; vocal hoarseness; and globus (Bartlett 2006). The stomach contents is



**Figure 4: Dental erosion from lemon pica during pregnancy. Biting daily into a cut wedge of lemon and sucking on it caused this erosion. The incisors are severely eroded.**

predominantly hydrochloric acid HCl, and has a low pH (<pH=2.00) and high buffering capacity. HCl is more destructive than acid beverages, and consequently when intra-oral, gastric juices cause mainly palatal rampant dental erosion (Valena and Young 2002). See Figure 1c.

With involuntary migration of gastric contents into the lower oesophagus, chronic acid irritation induces changes at the squamo-columnar gastro-oesophageal epithelial junction. From this, Barrett oesophagitis, a pre-malignant condition, may develop and medically patients complain of GORD (Peters et al 1993).

Mechanisms inducing GORD are diverse. Acid reflux is an uncomfortable unpleasant experience, but most symptoms are short-lived and transient (Krauss et al 1990). Acid reflux into the oesophagus occurs with reduced lower oesophageal sphincter pressure and motility (Bartlett et al 1999). Alcohol reduces oesophageal muscular tone, delays stomach emptying, irritates the mucosa and causes GORD (Vitale et al 1987). Poor posture and flexed positions when lying or bending may precipitate GORD (Kitchen and Catell 1991). Vigorous exercise like prolonged running, may induce nausea and heartburn from gastric regurgitation (Krauss et al 1990). Obesity causes raised intra-abdominal pressure and consequent gastric pressure that facilitates reflux (Hirsch et al 2003).

### **Extrinsic factors causing dental erosion**

Multiple frequent exposure to acidulated fruit drinks cause dental erosion, attrition and abrasion. Acidic juices are pleasant to drink, and an important source of nutrients, but frequency-of-consumption, method of drinking, quantity and type of beverage, timing of consumption and misguided habits (swishing), may cause long-term damage (Touyz and Mehio 2006). The pattern of erosion is different from that produced by GORD. The oral status changes and

dental complications do arise in patients with both anorexia and bulimia nervosa, but the erosive pattern differs from that of acid juice consumption. See Figures 1c and 5c. Prolonged periods of dietary restraint in anorexic patients does not change the bacteria associated with dental caries. Also patients do not have reduced decay rates or salivary flow. Some sufferers may develop gingivitis with gingival recession, but not any more periodontitis when compared to control subjects (Touyz et al 1993). The erosion arising from extrinsic influences shows a different pattern of crown loss on both palatal/lingual and buccal sides. Often just dentine stumps will remain after chronic abusive juice drinking. Cusps are reduced and there is all round loss of calcified tooth material from erosion. This is because the teeth are placed into the pool of juice when drinking and often the juice is swished rigorously to enhance flavour before swallowing. Old restorations stand out, and there is a reduction of vertical height from occlusal and incisal wear (Lussi and Helwig 2006, Touyz 1994) see Figures 5a-c.

Clinicians, healthcare workers, dieticians and the whole dental profession need to counsel patients about potential ravages to teeth arising from acidulated beverages. Fresh acidic fruit juices are a pleasant experience to drink, and an important source of vitamin C, electrolytes and carbohydrate (Touyz 1994).

### **Principles of therapy**

Early detection of erosion from intrinsic and extrinsic factors holds the best prognosis, as intervention therapies can minimize the risk of erosion. Once the cause has been defined, appropriate measures can be devised to eliminate the destructive behaviours.

For intrinsic causes of erosion, prevention of mordant acid attack is key to therapy (Lussi and Helwig 2006, Touyz 1994). This can be achieved through psychological and social counselling, aided by family support and mood altering psychotropic medication that may help with eating disorders (Touyz and Mehio 2006, Touyz et al 1995). Some pharmacological relief of acid heartburn and other discomforting symptoms relies on swallowing antacids, foaming agents, Histamine H<sub>2</sub>-receptor antagonists and proton pump inhibitors (PPI) (Canadian Pharmacists Association 2004). Antacids may contain aluminium hydroxide, magnesium hydroxide or magaldrate. Others contain calcium carbonate, magnesium-hydroxide or -carbonate, or mixtures of these. Foaming agents contain alginic acid and/or sodium alginate. H<sub>2</sub> antagonism is achieved by various molecules including cimetidine, famotidine, nizatadine and ranitidine HCl. PPI's contain lansoprazole, magnesium omeprazole, sodium-



**Figure 5a-c: Dental erosion from extrinsic factors. Erosion derived from excessive consumption of acid beverages. Note the characteristic pattern of erosion. Both buccal and palatal enamel has been eroded away. This pattern of erosion is decidedly different from that observed with GORD.**

pantoprazole and-rabeprazole (Canadian Pharmacists Association 2004). These drugs assist in coping with GORD for the short term, but they do not prevent recurrence, nor do they permanently cure the condition.

For extrinsic causes of erosion, improved oral hygiene habits and dietary counselling to minimise intake of acid food and drink is essential. Prevention of further erosion is indicated, especially if early signs are detected before major dental morbidity becomes obvious. Desensitisation of dentinal sensitivity coupled with sound dietary counselling often arrests the process (Touyz and Stern 1999). Scrutinising two-week dietary histories often helps people identify the acid sources in their diets. Drinking acid beverages as part of a meal, and avoiding drinking juices last thing at night before sleep, minimises acid erosion. Avoiding swishing before swallowing and reducing the volumes and frequency of acid drinks also helps. Drinking through a straw helps minimise acid erosion (Lussi and Helwig 2006, Touyz 1994) See Table 2.

Restoration of function and appearance of eroded teeth is challenging, demanding of high levels of skill, expense and patient co-operation. Specialised restorative techniques, including arresting and controlling decay, endodontics if indicated, composite resin coatings, occlusal build-up, overlays, onlays, porcelain veneers and full crowns, all as part of an oral rehabilitation, and as part of overall therapy, have been described. Relief of pain from dentinal sensitivity will be part of general patient management, with extraction being the least and last desirable option of therapy (Jaeggi et al 2006).

### Discussion

Erosion of teeth may arise from intrinsic and extrinsic factors, or on occasion, from a combination of both. Eating disorders in Western society is increasing in prevalence and is now also seen to be affecting males. There is a progressive increase in consumption of acidic soft drinks, from pop-sodas to fruit juices, as a regular part of the Western civilization diet in adolescents (Calvadini et al

1965). The fusion of these two major influences results in an increased incidence of erosion presented in general medical and dental practice. Medical practitioners may notice palatal dental erosion during routine intra-oral exams, with symptoms of GORD. In dental therapy, tooth pain from exposed dentine in conjunction with generalised erosion, may well indicate acid beverage erosion. Periodically, especially in adolescents, combinations of the two factors occur. A detailed medical and dental history should reveal the major causes of erosion and appropriate therapy, referrals and management can be determined from this.

### Concluding remarks

Attrition, abrasion and erosion are part of the aging process of any dentition. Accelerated damage or tooth loss, due to intrinsic or extrinsic influences manifests as one or a amalgamation of these. Early detection and prevention of breakdown is ideal. Teeth should last the lifetime of an individual. Severe damage, and/or premature loss of teeth, with consequent compromise of quality of life from ignoring erosion or mismanaging causes thereof, should not occur.

### Declaration

The authors have no conflict of interest to declare.

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**Table 2**

Counselling suggestions for Erosion. Based on Lussi and Helwig [1999] and Touyz [2006].

- Frequency: reduce exposure times per day
- Amount: imbibe less juice; dilute potable beverage with water
- Timing: drink beverage as part of a meal; avoid drinks before sleep
- Type of beverage: choose non-acid drinks or liquids saturated with calcium like milk
- Your habits: don't swish before swallowing; use a straw; don't sip repeatedly
- Avoid brushing immediately after an acid erosive challenge like emesis or an acid drink
- Never chew sugar containing gum after an acid drink
- Don't brush before an erosive challenge as dental pellicle provides some protection
- Use a soft tooth brush with low abrasivity and a non-abrasive paste with fluoride
- Swill, rinse and swish a slurry of fluoridated tooth paste after an acid drink
- Have regular dental check-ups
- Ensure oral hygiene products and medicines are not acidulated
- Refer patients with GORD for appropriate medical/ psychological attention

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